Day 3 (Thursday, 27 October) 11:15 - 12:45, Hall C
Technical Session 12　Air Traffic Management 4

T12-1-I

Free Route Airspace Implementation Efforts in the Latin America and Caribbean Region through Collaboration

Midori Tanino (Federal Aviation Administration)

The Federal Aviation Administration (FAA) and the Civil Air Navigation Services Organization (CANSO) organized the CANSO Air Traffic Flow Management (ATFM) Data Exchange Network for Americas (CADENA) Regional Implementation Group (RIG) in 2016. Since its establishment, CADENA has delivered many improvements that have led to the Free Route Airspace (FRA) implementation efforts in the Latin America and Caribbean (LAC) region. This presentation will show the background of CADENA and its foundation where many Air Navigation Service Providers (ANSPs), airlines, and other stakeholders work collaboratively. It presents the accomplishments made thus far. Accomplishments includes implementation of the Planned Airway System Alternatives (PASA) reroute database and end-to-end route request capability. It also shows two types of route optimization trials and their results, PASA route optimization 90-day trials and user preferred route (UPR) trials. The trials started in 2021 and CADENA will continue both types of trials during 2022 and 2023.

T12-2-A

Demand Assessment for Climate Optimal Aircraft Trajectories at Network Scale

Fateme Baneshi, Manuel Soler, Abolfazl Simorgh, Ivan Martinez (Universidad Carlos III de Madrid)

Aviation contributes to global warming through the emission of carbon dioxide (CO$_2$) and other non-CO$_2$ effects. The climate impact associated with non-CO$_2$ species highly depends on atmospheric location and time of the emissions. Hence, they can be mitigated by efficient climate-aware trajectory planning to avoid climate-sensitive regions. However, the increase in demand around climate hotspots caused by adopting individually optimized trajectories in a climate-friendly manner may not be practical due to the limited capacity of airspace. Consequently, the actual mitigation potential of climate impact needs to be analyzed at the network level to assess how the adoption of climate optimized trajectories affects Air Traffic Management (ATM) system performance. In this paper, we aim to study the effects of employing climate optimized trajectories on traffic demand. In this regard, taking climate impacts into account, aircraft trajectory optimization is performed for a scenario with 1006 flights in free-route airspace. Uncertainty in the meteorological conditions, as an essential factor affecting aircraft trajectories and estimated climate impacts, is addressed by performing ensemble trajectory prediction.
The traffic demand for optimized aircraft trajectories considering different routing options (ranging from cost-optimal to climate optimal) is then assessed. The results show that as we move toward trajectories with lower climate impacts, in addition to the increase in the operational cost, the demand is considerably increased in the sectors adjacent to climate hotspots.

T12-3-A

A Deep Neural Network Approach for Prediction of Aircraft Top of Descent

Hao Jie Ang, Qing Cai, Sameer Alam (Nanyang Technological University)

An arrival flight starts to transit from the cruise phase to the descent phase at the top of descent (TOD). Pilots get to know the TOD locations via on-board devices, while controllers can estimate the TOD locations with the help of radar surveillance and simple rules. In order to help controllers to get a better situation awareness of the traffic surrounding an aerodrome, it is of great operational importance to get an accurate prediction of the TOD locations for arrival flights. In this paper, we propose to apply deep learning for TOD location prediction for arrival flights. To do so, a TOD-specific feature engineering is suggested and applied to historical flight trajectories. Then the simple yet effective multilayer perceptron neural network model is adopted for TOD prediction. A case study on the arrival flights to Singapore Changi airport with respect to one-month historical trajectory data is carried out. Experiments demonstrate that the adopted deep learning method is effective for TOD location prediction. When compared against several typical machine leaning models for regression, the adopted model yields a mean square error of 0.0039, which is smaller than the error achieved by the comparison models. Meanwhile, the adopted deep learning model yields TOD location prediction errors of 0.29 nautical miles (NM) on average with a standard deviation of 46.88 NM.